STRESS ANALYSIS OF TRAPEZOIDAL NANOBEAM WITH ROUGHNESS

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Abstract: *The present study considers stress analysis of trapezoidal nanobeam with roughness using commercial finite element package ANSYS. Beams with surface roughness in the form of semicircular and grooved asperities and scratches are modeled. Asperity and scratch locations are varied to obtain their effect on bending stresses. Longitudinal stress and displacement are obtained for nanobeams with different roughness parameters simulating various roughness density and depth. The present results may be useful to designers of nanostructures.*

Keywords: *Nanobeam, Roughness, Finite element method.*

INTRODUCTION

Nanostructures are used in micro electromechanical systems (MEMS) and nano electromechanical systems (NEMS) applications. These devices are used in many applications like accelerometers, MEMS gyroscope, silicon pressure sensor etc. As these devices require high reliability, the nanostructures require reliability. Load applied on the devices during use may lead to component failure. So for the device to be reliable and able to resist the loads in daily usage, one needs to design the MEMS devices and the nanostructures taking into consideration of roughness features. Thus it is required to perform stress and deformation analysis of the nanostructures with roughness for optimal designing.

Mechanical properties of nanostructures are scale dependent. Young's modulus and bending strength of the nanobeam was measured by Sundararajan and Bhushan (2002) using atomic force microscopy. Finite element modelling of nanostructures is required for consideration of roughness on nanobeams. FEA is done conventionally down to micrometre scales and its application to nanoscale